Chapter 2
Interest Rate Changes and Investors' Activity: Evidence from Poland During the Pandemic Period

Joanna Olbrys

Abstract During the COVID-19 pandemic period in Poland, interest rates have been substantially reduced by National Bank of Poland (NBP). Within three months, the WIBOR 1Y rate fell from 1.84% (27 February 2020) to 0.3% (4 June 2020). The consequences of the Central Bank decision have been crucial for investors, as a one-time increase (decrease) in rates decreases (increases) the market value of assets. Changes in the term structure of interest rates unknown a priori to investors arise particularly often in economic downturns. According to the literature, investors have a greater appetite for risk-taking when interest rates are low, and it is not confined to institutions. Generally speaking, low-interest rates lead to significantly higher allocations to risky assets among diverse groups of investors. In this context, the goal of this study is to investigate whether shifts in interest rates affected investors' activity on the Warsaw Stock Exchange (WSE) within the pandemic period in 2020. Daily trading volume is utilized as a measure of investors' activity. The event window method is used to assess whether the mean results of daily trading volume during the pre-event, event and post-event time windows significantly differ between each other in the case of all event windows. A particular event window includes consecutive considerable declines in interest rates. Moreover, robustness tests are conducted. The empirical findings confirm that interest rate cuts during the pandemic period increased investors' activity on the Polish stock market.

Keywords COVID-19 pandemic period · Declining interest rates · Event window · Trading volume · Warsaw Stock Exchange

J. Olbrys (✉)
Bialystok University of Technology, Bialystok, Poland
e-mail: j.olbrys@pb.edu.pl

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2.1 Introduction

During the coronavirus pandemic, central banks have been entrenched as the first and main line of defence against economic and financial crises (Stiglitz et al., 2020). Cochrane (2020) indicates that there are some arguments for a sharp interest rate cut when serious economic disruption hits, but first of all governments need detailed, pandemic-induced financial crisis plans. The pandemic period constitutes a powerful reminder that the basic political and economic unit is the nation-state, and the borders suddenly do matter (Stiglitz et al., 2020). In March and April 2020, 21 central banks in advanced and emerging economies made quantitative easing announcements on government or government-backed securities. Some of these interventions were coupled with the substantial interest rates cuts, for instance, in Poland (Rebucci et al., 2020).

Changes in interest rates are crucial for investment decisions because a one-time increase (decrease) in rates decreases (increases) the market value of assets. Bae (1990) distinguishes current (anticipated) from unanticipated changes in interest rates. Ehrmann and Fratzscher (2004) document that equity returns react more strongly to monetary policy shocks when changes in interest rates are unexpected. Nissim and Penman (2003) point out that unanticipated shifts in interest rates should revise expectations of current and near-future revenues, expenses and earnings according to the direction of the interest rate change.

Unexpected changes in the term structure of interest rates unknown a priori to investors arise particularly often in economic downturns (Cieslak, 2018). According to the literature, investors have a greater appetite for risk-taking when interest rates are low, and it is not confined to institutions. In the recent paper, Lian et al. (2019) demonstrate that low-interest rates lead to significantly higher allocations to risky assets among diverse populations of institutional and individual investors. As a consequence, even rather conservative investors that usually exhibit a medium level of risk aversion seek more risky alternative investment opportunities. Several studies provide empirical evidence that banks, pension funds and mutual funds invest more in riskier assets when spot rates are low (e.g. Maddaloni & Peydró, 2011; Hanson & Stein, 2015; Andonov et al., 2017; Di Maggio & Kacperczyk, 2017; Daniel et al., 2018). In this context, a substantial rise of investors' activity on a stock market is not surprising when interest rates are low. Therefore, the proposed research question is as follows:

- *Did declining interest rates during the pandemic period affect investors' activity on the Polish stock market?*

To answer the research question, daily trading volume is used to investigate investors' activity on the Warsaw Stock Exchange (WSE). Trading volume is treated as a proxy of stock liquidity, and it is defined as a number of shares traded over a particular period of time (Olbryś & Oleszczak, 2020). The event window method is used to assess whether the mean results of daily trading volume during the pre-event, event and post-event time windows significantly differ between each other

in the case of all event windows. An event means a particular considerable decline in spot rates. However, a particular event window includes consecutive declines in interest rates. As a robustness check, we compare the empirical findings within the whole sample period and the event windows.

It is well documented in the literature that volume displays significant differences across trading hours of the day and across days of the week. Quite extensive studies of this topic have been conducted on the WSE (e.g. Będowska-Sójka, 2014; Nowak & Olbryś, 2015; Miłobędzki & Nowak, 2018; Olbryś & Oleszczak, 2020). However, to the best of the author's knowledge, the empirical findings concerning investors' activity measured by daily trading volume on the WSE during the COVID-19 pandemic period are novel and have not been reported in the literature thus far.

The remainder of this study is organized as follows: Section 2.2 presents the problem of unexpected changes in interest rates during the COVID-19 pandemic period in Poland. Section 2.3 describes the methodological background of the event window approach. Section 2.4 contains data description and discusses the empirical results of investors' activity on the WSE. The last section recalls the main findings, concludes and indicates further directions of the research.

2.2 Changes in Interest Rates During the Pandemic Period in Poland

During the pandemic period in Poland, interest rates have been substantially reduced by National Bank of Poland (NBP) to support economy and to enable the entrepreneurs to take out low-interest loans. As a consequence, within three months, the WIBOR 1Y (Warsaw Interbank Offered Rate 1Y) fell from 1.84% (27 February 2020) to 0.30% (4 June 2020). Table 2.1 reports details concerning daily percentage changes in WIBOR 1Y. The shifts that arose on 16 March 2020, 17 March 2020, 18 March 2020, 9 April 2020 and 29 May 2020 were the most critical.

Figures 2.1 and 2.2 illustrate the term structure of the WIBOR 1Y rates. For instance, Fig. 2.1 shows the almost flat interest rate structure in Poland during the one year period from 12 June 2019 to 12 June 2020. Figure 2.2 displays results reported in Table 2.1. Percentage changes in WIBOR 1Y within the period from 20 February 2020 to 5 June 2020 are presented.

It is important to note that after the quite long time period of almost flat interest rate structure in Poland, the topic regarding financial market risk caused by changes in interest rates has become significant again in 2020.

Table 2.1 Daily percentage changes in WIBOR 1Y during the period from 20 February 2020 to 12 June 2020

Date	WIBOR 1Y	Daily change in WIBOR 1Y (%)
2020-02-20	1.84%	0
.....		
2020-02-27	1.84%	0
2020-02-28	1.83%	−0.54%
.....		
2020-03-13	1.78%	0
2020-03-16	1.66%	**−6.74%**
2020-03-17	1.53%	**−7.83%**
2020-03-18	1.26%	**−17.65%**
2020-03-19	1.25%	−0.79%
2020-03-20	1.24%	−0.8%
2020-03-23	1.23%	−0.81%
2020-03-24	1.23%	0
.....		
2020-04-07	1.23%	0
2020-04-08	1.23%	0
2020-04-09	0.76%	**−38.21%**
2020-04-10	0.76%	0
2020-04-14	0.76%	0
.....		
2020-04-28	0.75%	−1.32%
2020-04-29	0.75%	0
.....		
2020-05-14	0.74%	−1.33%
.....		
2020-05-28	0.74%	0
2020-05-29	0.33%	**−55.41%**
2020-06-01	0.32%	**−3.03%**
2020-06-02	0.31%	**−3.13%**
2020-06-03	0.31%	0
2020-06-04	0.3%	**−3.23%**
2020-06-05	0.3%	0
.....		
2020-06-12	0.3%	0

Notes: The most critical changes in interest rates are marked in bold
Source: Olbryś (2020)

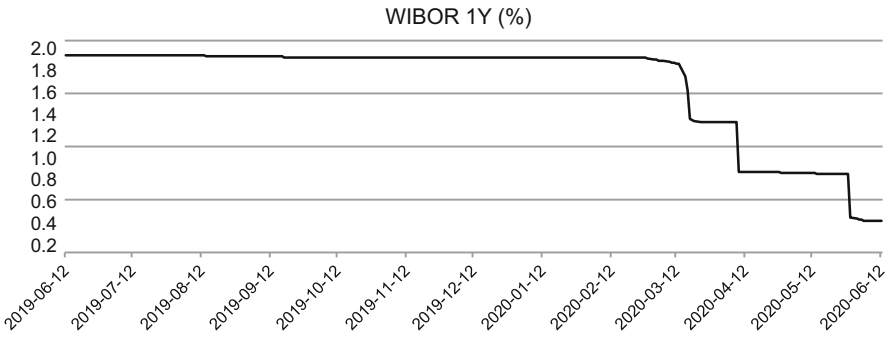

Fig. 2.1 WIBOR 1Y during the one year period from 12 June 2019 to 12 June 2020. (Source: Olbryś, 2020)

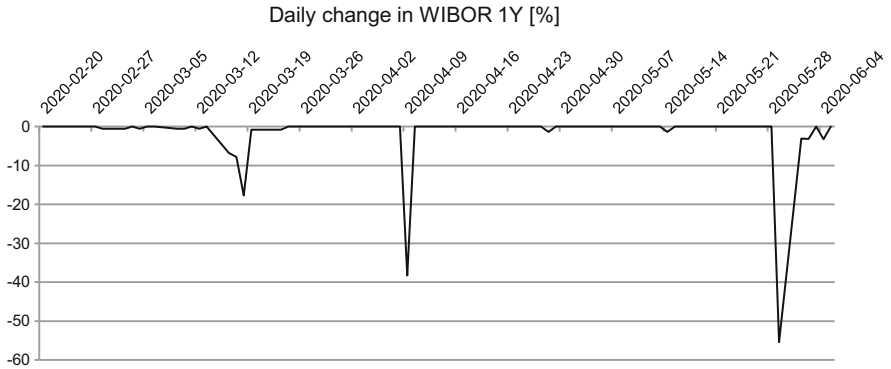

Fig. 2.2 Daily changes in WIBOR 1Y within the period 20 February 2020–5 June 2020. (Source: Olbryś, 2020)

2.3 The Event Window Approach

The event window framework is typical for event studies in economics and finance (MacKinlay, 1997). The event window approach requires constructing reasonable windows around the event dates (Di Maggio & Kacperczyk, 2017).

The aim of our event window study is to deeply investigate and compare daily trading volume behaviour around events related to the most critical changes in interest rates reported in Table 2.1. Defining $[T_1, T_2]$ as the event window that contains k-trading days, we base on MacKinlay (1997) and propose the following procedure for constructing the non-overlapping pre-event, event and post-event windows of equal length for daily data:

- Pre-event window $[T_1 - k, T_1 - 1]$ (k-trading days),
- Event window $[T_1, T_2]$ (k-trading days),
- Post-event window $[T_2 + 1, T_2 + k]$ (k-trading days).

Given daily percentage changes in WIBOR 1Y presented in Table 2.1, we consider the following four main event windows EW1, EW2, EW3 and EW4, with the corresponding pre-event and post-event time windows of equal length:

1. Event window 1 (EW1) from 16 March 2020 to 23 March 2020 (6 trading days)
   - Pre-event window 1 (Pre-EW1) from 6 March 2020 to 13 March 2020,
   - Post-event window 1 (Post-EW1) from 24 March 2020 to 31 March 2020.
2. Event window 2 (EW2) from 8 April 2020 to 14 April 2020 (3 trading days)
   - Pre-event window 2 (Pre-EW2) from 3 April 2020 to 7 April 2020,
   - Post-event window 2 (Post-EW2) from 15 April 2020 to 17 April 2020.
3. Event window 3 (EW3) from 29 May 2020 to 4 June 2020 (5 trading days)
   - Pre-event window 3 (Pre-EW3) from 22 May 2020 to 28 May 2020,
   - Post-event window 3 (Post-EW3) from 5 June 2020 to 12 June 2020.
4. Event window 4 (EW4) from 16 March 2020 to 4 June 2020 (55 trading days)
   - Pre-event window 4 (Pre-EW4) from 2 January 2020 to 13 March 2020,
   - Post-event window 4 (Post-EW4) from 5 June 2020 to 17 August 2020.

2.4 Data Description and Empirical Results on the WSE

This section describes the data set and presents empirical findings concerning comprehensive investigation of investors' activity on the WSE during the whole sample period from 2 January 2020 to 30 December 2020 (252 trading days), including the period of considerable declines in interest rates on Polish financial market, i.e. from 16 March 2020 to 4 June 2020.

2.4.1 Data Description

The data set consists of daily data and contains the opening, high, low and closing prices and volume for each security. The free historical market data come from the Stooq.pl (available at https://stooq.com/db/h/). The 18 major and most actively traded WSE companies and the WIG20 index as a benchmark are investigated. The equities were incessantly included in the WIG20 index within the whole sample period from 2 January 2020 to 30 December 2020. This information is based on the historical index portfolios (available at https://gpwbenchmark.pl/en-historyczne-portfele). Table 2.2 reports the basic information about all selected companies.

The whole sample period can be divided into the following two sub-periods: (1) before the COVID-19 pandemic lockdown from 2 January 2020 to 12 March 2020

Table 2.2 Basic information about the 18 major and most liquid WSE-listed companies included in the WIG20 index within the whole sample period

	Company	MV PLN m. (30 December 2020)	Average trading volume per session in 2020	Average no. of trades per session in 2020
1	KGH	24963.03	720721	5344
2	PKO	24630.07	3307051	7160
3	CDR	18500.50	536374	11307
4	PZU	18390.35	2362287	6045
5	PKN	16683.91	1512842	8262
6	DNP	13856.47	204769	3003
7	PEO	10776.76	1108242	5576
8	LPP	9154.93	3050	1131
9	PGN	9003.58	5830908	3314
10	CPS	8336.11	568826	1863
11	SPL	6185.30	92697	2028
12	PGE	5179.04	3668448	3549
13	OPL	4266.08	1899878	1781
14	LTS	3587.21	629846	3799
15	CCC	3307.38	586652	4848
16	TPE	2840.65	6807622	2523
17	ALR	1508.55	685050	2416
18	JSW	1365.90	1214032	4193

Notes: The 18 WSE-traded companies are labelled by ticker symbols and presented in decreasing order of the market value (MV in PLN million) on 30 December 2020
Source: The WSE website

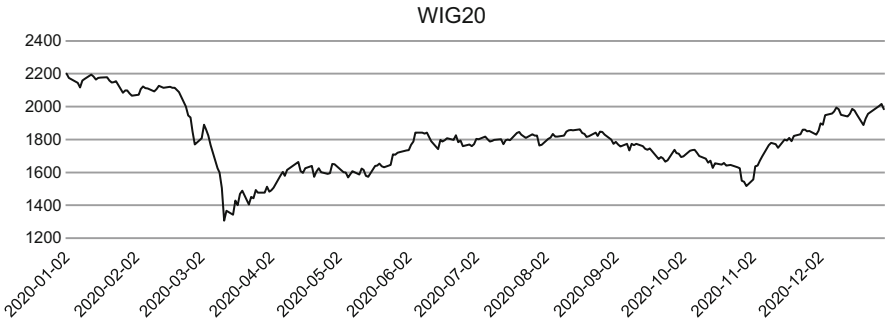

Fig. 2.3 Daily values of the WIG20 index within the whole sample period from 2 January 2020 to 30 December 2020

and (2) during and after the lockdown from 13 March 2020 to 30 December 2020. Daily values of the WIG20 index are presented in Fig. 2.3. It is pertinent to note that after the quite short period when the WIG20 index moved down substantially (with the lowest value equal to 1305.73 on 12 March 2020—the first day of the lockdown), the market index moved up within the subsequent sub-period.

2.4.2 Empirical Results on the WSE Based on the Event Window Approach

The main idea of the event window approach is to investigate a particular stock market characteristic's behaviour around events. Therefore, the goal of this study is to assess whether the mean results of daily trading volume during the pre-event, event and post-event time windows significantly differ compared to each other in the case of all event windows. To address this issue, the t-statistic for sample means is utilized:

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2(n_1-1)+s_2^2(n_2-1)}{n_1+n_2-2} \cdot \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}, \tag{2.1}$$

where $\overline{x_1}$ and $\overline{x_2}$ are sample means, s_1^2 *and* s_2^2 are sample variances, and n_1 and n_2 denote sample size, respectively. The following two-tailed hypothesis is tested:

$$\begin{aligned} H_0 &: \mu_1 = \mu_2 \\ H_1 &: \mu_1 \neq \mu_2 \end{aligned}, \tag{2.2}$$

where μ_1 and μ_2 are the expected values of daily trading volume during the compared periods, and the null hypothesis states that two expected values are equal. Tables 2.3, 2.4, 2.5, and 2.6 contain the summarized findings of the significance test for differences between two means for four event windows EW1, EW2, EW3 and EW4 in the chronological order based on Table 2.1. Standard deviations are given in parentheses. Calculations of the t-statistic (1) values are based on the sample empirical results presented in Tables 2.3, 2.4, 2.5, and 2.6. The null hypothesis is rejected when $|t| > t^*$, where the critical value of t-statistic at 10% significance level is equal to $t^* = t_{0,10;n_1+n_2-2}$.

The empirical findings reported in Tables 2.3, 2.4, 2.5, and 2.6 are not homogeneous. As would be anticipated, the investors' activity measured by daily trading volume was significantly higher during the first event window (Table 2.3). For instance, the null hypothesis of the equality of expected values was rejected for 14 out of 18 companies and the WIG20 index in the case of the pair post-EW1/EW1 sub-periods. The results suggest that the interest rate changes were unexpected, investors were rather surprised, and generally, they reacted violently to substantial interest rates cut. Tests for differences between two means for the second (EW2) and third (EW3) event windows are presented in Tables 2.4 and 2.5, and they show that these differences are not significant in the most cases. It is not surprising as the second pre-event, event and post-event time periods included the Easter holiday in Poland. The third event was the last one, and, less formally speaking, it seems that investors have accepted interest rate cuts.

Table 2.6 presents summarized results of the significance test for differences between two means for the fourth event window (EW4), which includes the whole

Table 2.3 Summarized results of the average daily trading volume, standard deviation and the significance test for differences between two means for the first event window (EW1)

		Average daily trading volume (standard deviation)			Hypothesis		
	Company	Pre-event window	Event window 1 (EW1)	Post-event window	Pre-EW1 /EW1	Post-EW1 /EW1	Pre-EW1 /Post-EW1
1	KGH	1318284.2(360765.4)	1695954.3(443975.4)	919140.7(259624.4)	H0	H1	H1
2	PKO	3964663.7(1421857.3)	6130055.2(1587269)	3293462.2(747492.5)	H1	H1	H0
3	CDR	815230.7(397957.5)	740655.5(225567)	338275(62824.7)	H0	H1	H1
4	PZU	3193154.8(1001207)	4188794.3(1139469)	2813320.5(602022.6)	H0	H1	H0
5	PKN	2433651.2(488011)	2487493.3(813423.5)	1759302.3(552576.4)	H0	H1	H1
6	DNP	370769.2(201750.8)	432834.7(136872.9)	230098.5(72609.3)	H0	H1	H0
7	PEO	1101058.5(457518.8)	1676369(466359.6)	861188(212601.9)	H1	H1	H0
8	LPP	5864.5(1466.63)	8264.33(3154.94)	3420.5(957.87)	H0	H1	H1
9	PGN	10110307.7(2310598.8)	15241999(5200387)	11599021(8767743)	H1	H0	H0
10	CPS	1205310.2(535202.6)	1433322.3(518098)	781429.3(444670.5)	H0	H1	H0
11	SPL	107873.2(44045.7)	158479.3(70144.2)	118907.5(44553.2)	H0	H0	H0
12	PGE	5175149.2(2442760)	9751551.3(4056472)	4553622.2(884153.8)	H1	H1	H0
13	OPL	3941452.2(1216222)	3568289.8(1328982)	2127740.7(931748)	H0	H1	H1
14	LTS	640689.2(210909.9)	701515.8(256866.4)	655976(129863.8)	H0	H0	H0
15	CCC	499833.5(479629.4)	2237457.2(708452.9)	774915.2(375715.3)	H1	H1	H0
16	TPE	10151277.3(4851047)	17183343.8(10027134)	7534241.8(1401942)	H0	H1	H0
17	ALR	997482(167159)	994104.3(321315.1)	870222.8(286411)	H0	H0	H0
18	JSW	1689321.7(555531.9)	2352053.7(886755.6)	1007259.7(212430.9)	H0	H1	H1
index	WIG20	48422554(14773523)	71585113(23636260)	40498573(11320598)	H1	H1	H0
No. of H1					6	15	6

Notes: The companies are presented in Table 2.2
H0—the null hypothesis; H1—the alternative hypothesis
EW1: 16.03.2020–23.03.2020 (6 trading days)
Pre-EW1: 6.03.2020–13.03.2020
Post_EW1: 24.03.2020–31.03.2020

Table 2.4 Summarized results of the average daily trading volume, standard deviation and the significance test for differences between two means for the second event window (EW2)

		Average daily trading volume (standard deviation)			Hypothesis		
	Company	Pre-event window	Event window 2 (EW2)	Post-event window	Pre-EW2 /EW2	Post-EW2 /EW2	Pre-EW2 /Post-EW2
1	KGH	1493043.3(473913.8)	1394585.7(947601)	1383785(541888.1)	H0	H0	H1
2	PKO	4774935.3(2023629.6)	5186777.3(2134481.5)	4864929.3(207458.9)	H0	H0	H0
3	CDR	459955.7(92803.7)	468782(198071.8)	407094.3(169533.8)	H0	H0	H0
4	PZU	2370520(481481)	3432189.3(499258.8)	3351073(1505531.9)	H1	H0	H0
5	PKN	4258645.3(2925377.1)	2265526.3(257619.8)	2458885.7(745688.4)	H0	H0	H0
6	DNP	235044(37984.7)	182802.3(25740.9)	298705.7(207709)	H0	H0	H0
7	PEO	1208728(619507.9)	3126350(538221.6)	1262299.3(239873.9)	H1	H1	H0
8	LPP	4140(1365)	3993(330)	3278.7(504.7)	H0	H0	H0
9	PGN	13394533(2823218.9)	10450321.7(1183764.2)	5757780(1437499.3)	H0	H1	H1
10	CPS	811099.7(136521.8)	961895.3(644252.2)	853643.3(374307.4)	H0	H0	H0
11	SPL	168214.3(16918.1)	165463.3(18383.8)	165119.3(34153.9)	H0	H0	H0
12	PGE	6384640(1050919.8)	6092275.3(708919.9)	6442521.7(2034605.8)	H0	H0	H0
13	OPL	1757677.7(517657.7)	2447353.3(1283630.6)	1502673.3(526141.5)	H0	H0	H0
14	LTS	901005.7(134268.5)	686117.3(215107.1)	605846.7(200549.2)	H0	H0	H0
15	CCC	1369114.3(642747)	1095918.7(543437.4)	2148231.7(1445428.9)	H0	H0	H0
16	TPE	10492365(2829502.7)	8789022.3(1323263.6)	10039507(3302804.1)	H0	H0	H0
17	ALR	1670917.3(894547.3)	2451843.7(1442481.4)	1742154.7(572784.1)	H0	H0	H0
18	JSW	1403336.7(473913.8)	1394585.7(947601)	1383785(541888.1)	H0	H0	H0
index	WIG20	53338987(10052333)	50918988(4764116.4)	45248136.7(4717268.6)	H0	H0	H0
No. of H1					2	2	2

Notes: The companies are presented in Table 2.2
H0—the null hypothesis; H1—the alternative hypothesis
EW2: 8.04.2020–14.04.2020 (3 trading days)
Pre-EW2: 3.04.2020–7.04.2020
Post_EW2: 15.04.2020–17.04.2020

Table 2.5 Summarized results of the average daily trading volume, standard deviation and the significance test for differences between two means for the third event window (EW3)

		Average daily trading volume (standard deviation)			Hypothesis		
	Company	Pre-event window	Event window 3 (EW3)	Post-event window	Pre-EW3 /EW3	Post-EW3 /EW3	Pre-EW3 /Post-EW3
1	KGH	730377.8(427613)	751879.8(277039.2)	734354,2(171877.2)	H0	H0	H0
2	PKO	5387389.6(5309144.3)	6877376.4(3051587.8)	7113249(1307693.9)	H0	H0	H0
3	CDR	371140.2(226222.8)	420750.6(257836.7)	369764(68947.7)	H0	H0	H0
4	PZU	2382568.2(1373812.8)	2914328.4(1255817.7)	2678489.4(551131.8)	H0	H0	H0
5	PKN	1046944.4(643790.7)	1501975(670620.3)	1824906.2(405960)	H0	H0	H1
6	DNP	218084.2(50179.5)	315405(151013.9)	224757.2(118796.9)	H0	H0	H0
7	PEO	3135569.8(2442806.3)	2725592.8(1780667.7)	2484646.8(736394.1)	H0	H0	H0
8	LPP	2742(1230.1)	3917.2(2362.7)	3961.6(881.3)	H0	H0	H0
9	PGN	11583277(10926558)	8001728.8(4350809.6)	5726270.6(1338455.6)	H0	H0	H0
10	CPS	579311.2(359770.7)	1397230.8(1445820.1)	688206.2(159127.1)	H0	H0	H0
11	SPL	198973.2(163208.7)	185360.2(102846.9)	151921.4(35854.9)	H0	H0	H0
12	PGE	3641426.8(2053599.1)	7709299(1525358.3)	11378102.6(5189339.3)	H1	H0	H1
13	OPL	1927561.6(1317917.7)	3633220.2(2367038.9)	1746645.4(539593)	H0	H0	H0
14	LTS	409506(282356.8)	650659(274748,8)	467008.8(212790.9)	H0	H0	H0
15	CCC	820800.6(510151.6)	2198973.6(1033415.6)	1372478(1150619.3)	H1	H0	H0
16	TPE	5195695.8(3807165.4)	11504588(5595983)	29527138.4(21852611)	H1	H0	H1
17	ALR	1659558(1211671)	1318216.8(378593.4)	2103426(1162920.4)	H0	H0	H0
18	JSW	1676613.4(1003044.4)	1809568(475022.8)	2739279.6(1447781.7)	H0	H0	H0
index	WIG20	41897899(23776764)	54492201.6(15308595)	72024145.4(21799664)	H0	H0	H1
No. of H1					3	0	4

Notes: The companies are presented in Table 2.2
H0—the null hypothesis; H1—the alternative hypothesis
EW3: 29.05.2020–4.06.2020 (5 trading days)
Pre-EW3: 22.05.2020–28.05.2020
Post_EW3: 5.06.2020–12.06.2020

Table 2.6 Summarized results of the average daily trading volume, standard deviation and the significance test for differences between two means for the fourth event window (EW4)

		Average daily trading volume (standard deviation)			Hypothesis		
	Company	Pre-event window	Event window 4 (EW4)	Post-event window	Pre-EW4 /EW4	Post-EW4 /EW4	Pre-EW4 /Post-EW4
1	KGH	694006(404036.5)	875199.9(488611.3)	803604(344971.1)	H1	H0	H0
2	PKO	2743302(1256227.6)	4380278(2438456)	3019648.7(1938472.6)	H1	H1	H0
3	CDR	477268.4(429410.6)	385561.3(194782.7)	346916.6(162862.7)	H0	H0	H1
4	PZU	2060714.7(900521)	2678266.3(1135372.1)	1970064.1(930484.8)	H1	H1	H0
5	PKN	1468119(675954.8)	1876248.4(1114062.7)	1296410.4(928581.2)	H1	H1	H0
6	DNP	203498.7(127978.9)	262811.8(127527.6)	163693.6(86431.7)	H1	H1	H1
7	PEO	689348.4(418390.5)	1852070(1229508.5)	977385.2(658549.5)	H1	H1	H1
8	LPP	2544(1856.1)	3936(2401.8)	3474.8(1759.1)	H1	H0	H1
9	PGN	5970444.4(2972211.1)	8315920.6(6180950.3)	5832263.3(3488933.4)	H1	H1	H0
10	CPS	551908.5(416506.8)	805418(603577.2)	515594(318984.6)	H1	H1	H0
11	SPL	69222(39625.3)	143232.8(72708.2)	88168.7(57696.7)	H1	H1	H1
12	PGE	2518705.5(1647675.5)	5119910.3(2751211.1)	4743267.9(4259850.9)	H1	H0	H1
13	OPL	2259336.5(1300709.4)	2128203.9(1316684.9)	1713027.4(1431518.4)	H0	H0	H1
14	LTS	367016.8(199881.5)	489345.6(261308.6)	437012.4(284456.7)	H1	H0	H0
15	CCC	274505.6(231542.6)	1390467.9(988971.2)	434356(493779.4)	H1	H1	H1
16	TPE	4609467.7(3487431.3)	7894857.6(5532355.2)	12283139.3(12587410)	H1	H1	H1
17	ALR	503948.9(347782.2)	1148188.9(730445.4)	679828(630810.8)	H1	H1	H1
18	JSW	1277019.8(680971.7)	1237215.3(739113.5)	783697.2(828113)	H1	H1	H1
index	WIG20	27185445(12738152)	41568467.4(18810324)	36503170.2(22073742)	H1	H0	H1
No. of H1					16	12	12

Notes: The companies are presented in Table 2.2
H0—the null hypothesis; H1—the alternative hypothesis
EW4: 16.03.2020–4.06.2020 (55 trading days)
Pre-EW4: 2.01.2020–13.03.2020
Post_EW4: 5.06.2020–17.08.2020

period of considerable declines in interest rates on Polish financial market, i.e. from 16 March 2020 to 4 June 2020. The empirical findings are interesting and worth special notice as they confirm that daily trading volume was significantly higher during this period for 14 out of 18 companies, namely KGH, PKO, PZU, PKN, DNP, PEO, LPP, PGN, CPS, SPL, PGE, LTS, CCC and ALR. This evidence is consistent with the hypothesis that declining interest rates during the pandemic period affected investors' activity on the Polish stock market.

2.4.3 Robustness Analyses

The additional goal of the study is to conduct robustness tests and assess whether the mean results of daily trading volume during the whole sample period and the event windows (EW1, EW2, EW3 and EW4) significantly differ compared to each other. To address this issue, the *t*-statistic (1) is utilized, and the two-tailed hypothesis (2) is tested. Summarized findings are reported in Table 2.7, and they require some comments. The null hypothesis H0 is outweighed by the hypothesis H1 in 10 out of 19 cases for the pair WS/EW1 and in 15 out of 19 cases for the pair WS/EW4, including the WIG20 index. It indicates that the mean results of daily trading volume during these periods significantly differ compared to each other. The evidence is that the influence of the first interest rate changes was the most crucial. The further changes were less important. Moreover, taking into consideration the whole sample period (WS) and the period including all interest rate cuts (EW4), the results confirm that trading volume was significantly higher during the EW4 time window. All these observations are in accordance with expectations.

2.5 Concluding Discussion

This paper is geared towards practical implications of changes in the term structure of interest rates unknown a priori to investors. Lian et al. (2019) investigate a phenomenon referred to as 'reaching for yield', which means that individuals invest more in risky assets when risk-free rate is low. The authors propose to explain this phenomenon by mechanisms related to investor's preferences and psychology rather than by conventional portfolio choice theory. They document that preferences and psychology may affect financially well-educated individuals as well as professional investors. The authors conclude that increased risk-taking may help stimulate the economy, but may also pose challenges for financial stability.

The low-interest-rate monetary policy is crucial for investors' decisions. Daniel et al. (2018) study the impact of monetary policy on investors' portfolio choices and asset prices. Their findings suggest that low-interest-rate policy may affect the risk premium of income-generating assets, lead to under-diversification of portfolios and cause redistributive effects across companies that differ in dividend policy.

Table 2.7 Summarized results of the significance test for differences between two means of the average daily trading volume for the group of companies

	Company	The whole sample average daily trading volume (standard deviation)	Hypothesis			
		WS/EW1	WS/EW2	WS/EW3	WS/EW4	
1	KGH	720721.2(371443.3)	H0	H0	H0	H1
2	PKO	3307050.8(1972772.1)	H1	H1	H1	H1
3	CDR	536374.2(623905.1)	H0	H0	H0	H1
4	PZU	2362286.9(1247000)	H0	H0	H0	H1
5	PKN	1526883.4(964467.7)	H0	H0	H0	H1
6	DNP	204768.8(129917.7)	H1	H0	H0	H1
7	PEO	1108241.8(856628.9)	H1	H1	H1	H1
8	LPP	3049.7(1905.3)	H0	H0	H0	H1
9	PGN	5896585.9(4092393.2)	H0	H1	H0	H1
10	CPS	586182.2(428849.3)	H1	H0	H0	H1
11	SPL	9269.7(60342.9)	H1	H1	H1	H1
12	PGE	3668448.3(2814256.5)	H1	H0	H1	H1
13	OPL	1899877.5(1248510.6)	H1	H0	H0	H0
14	LTS	637717.2(858793.7)	H0	H0	H0	H0
15	CCC	586651.8(699532.8)	H1	H0	H1	H1
16	TPE	6807621.8(7297218.2)	H0	H0	H1	H0
17	ALR	685049.5(568666.7)	H1	H1	H1	H1
18	JSW	1214032(922164.1)	H0	H0	H1	H0
index	WIG20	33313843.6(17035511.5)	H1	H0	H1	H1
No. of H1			10	5	9	15

Notes: The companies are presented in Table 2.2
H0—the null hypothesis; H1—the alternative hypothesis
WS: 2.01.2020–30.12.2020 (252 trading days)
EW1: 16.03.2020–23.03.2020 (6 trading days)
EW2: 8.04.2020–10.04.2020 (3 trading days)
EW3: 29.05.2020–4.06.2020 (5 trading days)
EW4: 16.03.2020–4.06.2020 (55 trading days)

Di Maggio and Kacperczyk (2017) stress that monetary authorities worldwide introduce a policy of keeping short-term interest rates at record low level.

Taking the above into consideration, the goal of this research was to assess whether considerable declines in interest rates increased the Polish stock market activity during the pandemic period. The empirical findings based on the event window approach confirm that daily trading volume within the period of the rate cuts was significantly higher for the most analysed companies. It means that low-interest rates led to significantly higher allocations to risky assets on the Warsaw Stock Exchange. This evidence is consistent with the literature. For instance, Brzeszczyński and Kutan (2015) suggest that the Polish Central Bank actions increase investors' activity. Gurgul and Majdosz (2005) examine whether base rate announcements released by the National Bank of Poland have a significant impact on stock returns and trading volume, but their findings are not such homogenous.

Di Maggio and Kacperczyk (2017) assess the influence of low-interest-rate policy on the U.S. money fund industry, and their empirical findings come from an event study analysis of monetary authority announcements. Therefore, one of the possible directions for further research could be to conduct a full event study to identify the impact of low-interest-rate policy during the pandemic period on asset returns on the WSE. To the best of the author's knowledge, no such investigation has been conducted on the Polish equity market thus far.

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